059102

DATA EVALUATION RECORD

1. Chemical: Chlorpyrifos-methyl (Shaughnessy #059102)

2. Formulation: Purity Not Stated

3. Citation: Shellenberger, T.E. 1970. Toxicological evaluations of DOWCO 214 with wildlife and DOWCO [redacted]/79 with mallard ducklings. Gulf South Research Institute, New Iberia, LA. (Letter to E. E. Kenaga, Dow Chemical Co., Midland, Michigan). (Report #5 within Accession No. 242149).

4. Reviewed by: James D. Felkel
   Wildlife Biologist
   Ecological Effects Branch/HED

5. Date Reviewed: 5/23/80

6. Test Type: 1) Avian dietary LC_{50}

   2) Cholinesterase Inhibition

   A. Test Species: Bobwhite Quail (Colinus virginianus)
   Japanese Quail (Coturnix c. japonica)
   Mallard (Anas platyrhynchos)
   (Scientific names not provided in report)

7. Reported Results:

   The dietary LC_{50} is 1835 (1550-2180) ppm with Bobwhite Quail, >5000 ppm with Japanese Quail, and 2500-5000 ppm with Mallard ducklings for the compound Chlorpyrifos-methyl.

8. Reviewer's Conclusions:

   Although the study appears to be scientifically sound, certain information gaps and discrepancies from guidelines exist (see Reviewer's Evaluation below). As submitted, the study does not fulfill the requirement for an avian dietary study. LC_{50} values of 1616 ppm for Bobwhite Quail, >5000 ppm for Japanese Quail, and 3621.9 ppm for Mallard as determined by this Reviewer would indicate that Chlorpyrifos-methyl is "slightly toxic" to Bobwhite Quail and Mallard, and "practically non-toxic" to Japanese Quail, following EPA approved toxicity criteria.

Materials/Methods

A. Test Procedure

A U.S. Department of Agriculture protocol was followed and described. All birds used in all tests were 5-7 days old. Range-finding studies were conducted by testing various dosage levels on groups of birds, each composed of 10 Mallard ducklings. Based on the results of these tests, five experimental dietary levels were established for the three test species; the levels were geometrically spaced over a range expected to produce 20-80% mortality in these birds. 20 birds were tested at each dosage level for the two quail species. A total of 30 Mallards, including those from the range-finding study, were tested at each dosage level. Negative control groups of 20 individuals of each species were fed chemical-free diets. Positive controls, using crystalline p,p'-DDT were run using 20 individuals at each of the 5 dosage levels.

The chemicals were added to the bird food as acetone solutions and mixed to remove all traces of acetone. Acetone was similarly mixed with the negative control food. Feed and water were available ad libitum for 5 days, followed by a three-day observation period. Body weights were obtained at the start and after the five-day feeding period. Mortality was recorded daily.

Effects of Chlorpyrifos-methyl on cholinesterase levels in Mallard duckling blood and brain tissues were evaluated by feeding five groups of five Mallards selected levels of the test chemical. Levels chosen were the two lowest levels used in the acute dietary study plus three lower levels. A control group received a pesticide-free diet. Birds were sacrificed after a five-day feeding period and enzyme activity determined electrometrically.

B. Statistical Methods

Methods used were not specified.

Discussion/Results

LC_{50} values were 1835 (1550-2180) ppm with Bobwhite Quail and >5000 ppm with Japanese Quail. Convulsions and other toxic symptoms were seen in the Bobwhite Quail but not the Japanese Quail. DDT LC_{50} levels were within the range expected for these species and the maximum negative control mortality was 5%, with Bobwhite Quail (see Table 1). Feed consumption in Bobwhite Quail was somewhat reduced at the 1250 ppm treatment level of chlorpyrifos-methyl and weight gain markedly reduced at the 2500 ppm level. Feed consumption in Japanese Quail began dropping off most noticeably at the 1250 ppm level with weight gain reductions dropping off at the 2500 ppm level of chlorpyrifos-methyl treatment, but not as sharply as with the Bobwhite Quail (see Table 2).

The Mallard LC_{50} value was 2500-5000 ppm for chlorpyrifos-methyl. DDT toxicity was within the expected range (see Table 3). Dose-related toxic symptoms including convulsions were seen for both chemicals while cholinesterase activity increased in whole blood for those individuals fed 39 ppm of the test chemical, inhibitions ranging from 71% of control at 78 ppm to

16% of control at 625 ppm occurred. No effect on cholinesterase activity in brain tissue was observed at the dietary levels tested (see Table 5). Body weight gains and feed consumption were also similar to controls at these test levels (see Table 4).

Reviewer's Evaluation

A. Test Methods

Discrepancies in test methods from basic and specific test standards in EPA Proposed Guidelines (1978) include:

1) No information on whether the test substance was stored under conditions that maintain its stability, and;

2) 5-7 day-old birds rather than 10-17 day-old birds were used.

Discrepancies from the reporting requirements of the 1978 Proposed Guidelines include:

1) Source, strain, and breeding history of test organisms were not provided;

2) Housing temperature, humidity, and lighting conditions were not reported;

3) Study dates were not reported;

4) Manufacturing lot and sample number of test substances and percent purity were not reported, and;

5) Source of water was not reported.

B. Statistical Analysis

Discrepancies from reporting requirements of the 1978 Proposed Guidelines include:

1) Method used to calculate the LC_{50} values was not provided and;

2) A specific LC_{50} value for the Mallard was not provided even though the LC_{50} was reported to be <5000 ppm (the level above which a specific value is not required).

A discrepancy from accepted protocols was the missing calculation of the slope of the dose-response line.

Range-finding and definitive test results should not be combined to calculate an LC_{50}, as appeared to be done for the Mallard results.

C. Results/Discussion

LC_{50} values calculated by this reviewer using the SAS Probit Analysis computer program are as follows: Bobwhite Quail 1616 ppm
(Confidence interval not calculable)

Japanese Quail >5000 ppm
(Specific value not calculable)

Mallard 3621.9 ppm
(95% confidence limits: lower = 2547 ppm; upper = 6444 ppm)

Except for Japanese Quail where a specific LC_{50} value was not calculable, the above values are lower than those submitted and indicate a slightly greater toxicity of the test compound. Following EPA - accepted toxicity criteria, these values indicate that Chlorpyrifos-methyl is "slightly toxic" to Bobwhite Quail and Mallard and "practically non-toxic" to Japanese Quail.

If the reduced feed consumption in the two Quail species were not to occur in any future field application of this material, the increased hazard of the increased pesticide consumption (relative to this test) must be determined.

D. Conclusions:

1. Category: Supplemental

2. Rationale: There were information gaps and other undefended discrepancies from EPA test standards, reporting requirements, and accepted protocols (see Reviewer's Evaluation above).

3. Repairability:

Completion of the majority of the information gaps or explanation of discrepancies may enable the Bobwhite Quail and Mallard data to meet Core status. The Japanese Quail data cannot meet Core status since this species is not established in the U.S.

Table 1

Acute Toxicity Values of DOWCO® 214 and p,p'-DDT to Bobwhite and Japanese Quail Chicks

Chemical	Dietary Level (ppm)	No Birds	Cummulative Mortality (%) 5 day[a]	Cummulative Mortality (%) 8 day[a]	LC_{50} Values[b] (ppm)
		Bobwhite Quail			
—	0	20	0	5	
DOWCO® 214	312	20	5	10	1835
	625	20	0	5	(1550-2180)
	1250	20	0	0	
	2500	20	75	90	
	5000	20	100	100	
DDT	150	20	5	5	790
	300	20	0	0	(690-910)
	600	20	0	5	
	1200	20	100	100	
	2400	20	100	100	
		Japanese Quail			
—	0	20	0	0	
DOWCO® 214	312	20	0	0	>5000
	625	20	0	0	
	1250	20	0	0	
	2500	20	0	0	
	5000	20	5	5	
DDT	150	20	0	10	380
	300	20	10	10	(310-455)
	600	20	85	100	
	1200	20	100	100	
	2400	20	100	100	

a 5-day chemical feeding period and 3-day observation period

b Based on total mortality obtained during the 8-day experimental period

Table 2

Body Weight and Feed Consumption of Bobwhite and Japanese Quail Fed Diets Containing DOWCO® 214 or p,p'-DDT

Chemical	Dietary Level (ppm)	Day 0	Day 5	Weight Gain (g)	Feed Consumption (g/bird/day)
		Bobwhite Quail			
—	0	10.0(20)	17.5(20)	7.5	2.8
DOWCO® 214	312	10.0(20)	18.9(19)	8.9	2.3
	625	9.7(20)	18.5(20)	8.8	2.3
	1250	10.0(20)	17.2(20)	7.2	1.3
	2500	9.7(20)	12.0(5)	2.3	0.7
	5000	10.0(20)	-	-	-
DDT	150	9.5(20)	19.7(19)	10.2	2.8
	300	9.7(20)	17.5(20)	7.8	3.1
	600	9.0(20)	17.5(20)	8.5	2.4
	1200	10.0(20)	-	-	-
	2400	10.0(20)	-	-	-
		Japanese Quail			
—	0	12.7(20)	27.5(20)	14.8	6.0
DOWCO® 214	312	13.2(20)	28.7(20)	15.5	5.4
	625	13.0(20)	27.0(20)	14.0	6.8
	1250	13.0(20)	27.0(20)	14.0	4.3
	2500	13.7(20)	26.5(20)	12.8	4.5
	5000	13.5(20)	22.6(19)	9.1	3.4
DDT	150	13.5(20)	28.7(20)	15.2	7.8
	300	12.7(20)	30.5(18)	17.8	5.8
	600	12.5(20)	33.3(3)	20.8	6.1
	1200	12.7(20)	-	-	-
	2400	13.7(20)	-	-	-

a 5-day chemical feeding period; number of birds in parentheses

Table 3

Acute Toxicity Values of DOWCO® 179, DOWCO® 214, and p,p'-DDT to Mallard Ducklings

Chemical	Dietary Level (ppm)	No Birds	Cummulative Mortality (%) 5 day[a]	Cummulative Mortality (%) 8 day[a]	LC_{50} Values[b] (ppm)
	0	30	0	0	
DOWCO® 179	100	10	0	10	180 (150-220)
	140	20	40	40	
	200	30	50	53.3	
	285	20	95	95	
	400	30	87	90	
	570	20	100	100	
DOWCO® 214	312	30	3.3	6.6	2500-5000
	625	30	10	10	
	1250	30	13.3	13.3	
	2500	30	33.3	40	
	5000	30	60	63.3	
DDT	150	30	40	40	525 (275-990)
	300	30	20	20	
	600	30	50	53.3	
	1200	30	90	93.5	
	2400	30	100	100	

a 5-day chemical feeding period and 3-day observation period

b Based on total mortality obtained during the 8-day experimental period

Table 4

Body Weight and Feed Consumption of Mallard Ducklings Fed Diets Containing DOWCO® 179 or DOWCO® 214

Chemical	Dietary Level (ppm)	Average Body Weight(g)[a] Day 0	Day 5	Gain	Feed Consumption (g/bird/day)
	0	66.8(5)	141.2(5)	74.4	35.4
DOWCO® 179	1	68.0(5)	162.4(5)	94.4	34.0
	3	70.4(5)	171.8(5)	101.4	36.8
	10	63.4(5)	152.8(5)	89.4	34.4
	30	62.6(5)	128.4(5)	65.8	31.6
	90	58.6(5)	72.0(4)	13.4	15.6
	270	74.8(5)	50.0(2)	-24.8	6.7
DOWCO® 214	39	63.6(5)	147.0(5)	83.4	31.6
	78	67.8(5)	147.5(5)	79.7	31.2
	156	64.2(5)	146.7(4)	82.5	27.6
	312	63.8(5)	142.0(5)	78.2	33.0
	625	67.0(5)	149.4(5)	82.4	36.0

a Number of animals in parentheses; 5-day chemical feeding period

Table 5

Whole Blood and Brain Cholinesterase of Mallard Ducklings Fed Diets Containing DOWCO® 179 or DOWCO® 214

Dietary Level (ppm)	Whole Blood Activity[a]			Brain Activity[a]		
	Avg.	Range	%	Avg.	Range	%
0	1.06(5)[b]	0.97-1.28	100	2.34(5)[b]	2.26-2.39	100
		DOWCO® 179				
1	0.74(5)	0.44-1.06	70.0[c]	1.96(5)	1.65-2.24	83.8[c]
3	0.34(5)	0.23-0.63	32.1	2.12(5)	1.94-2.26	90.5
10	0.37(5)	0.23-0.45	34.9	2.16(5)	1.96-2.24	92.3
30	0.41(5)	0.20-0.53	38.7	2.00(5)	1.65-2.15	85.4
90	0.18(4)	0.11-0.26	17.0	0.68(4)	0.57-0.82	29.1
270	0.13(1)		12.3	0.76(1)	-	32.5
		DOWCO® 214				
39	1.30(5)	1.19-1.39	12.15 ~~12.15~~	2.27(5)	2.20-2.32	97.0
78	0.75(5)	0.39-1.15	70.8	2.31(5)	2.29-2.33	98.7
156	0.26(4)	0.20-0.33	24.5	2.32(4)	2.29-2.39	99.2
312	0.21(5)	0.15-0.33	19.8	2.28(5)	2.22-2.33	97.5
625	0.17(5)	0.11-0.23	16.1	2.28(5)	2.26-2.30	97.5

a ΔpH determined at end of 5-day chemical feeding period

b Number of birds in parentheses

c Activity determined relative to control group, 0 ppm